

Fluorinated Gas Production



Subpart L, Mandatory Reporting of Greenhouse Gases

Under the Mandatory Reporting Rule for Additional Sources of Fluorinated Greenhouse Gases, owners or operators of facilities that contain fluorinated gas production processes (as defined below) and whose uncontrolled emissions equal or exceed 25,000 metric tons of carbon dioxide equivalent per year from fluorinated gas production, stationary combustion, miscellaneous use of carbonates, and other source categories (see information sheet on General Provisions- subpart A) must report emissions from all source categories located at the facility for which emission calculation methods are defined in the rule. Owners or operators must collect emission data, calculate greenhouse gas (GHG) emissions, and follow the specified procedures for quality assurance, missing data, recordkeeping, and reporting.

Producers of fluorinated gases should also review the requirements of 40 CFR part 98, subparts O and OO (HCFC-22 Production and HFC-23 Destruction; Suppliers of Industrial Greenhouse Gases) to determine if they must also report emissions under those subparts.

How Is This Source Category Defined?

The fluorinated gas production source category consists of processes that produce fluorinated gases from any raw material or feedstock chemical. Fluorinated gases include fluorinated GHGs (described further below), chlorofluorocarbons (CFCs), and hydrochlorofluorocarbons (HCFCs). This source category does not include reuse or recycling of fluorinated gases and the generation of HFC-23 from the production of HCFC-22. Emissions of HFC-23 from HCFC-22 production are covered in subpart O (HCFC-22 Production and HFC-23 Destruction).

What GHGs Must Be Reported?

Fluorinated GHGs include hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF₆), nitrogen trifluoride (NF₃), hydrofluoroethers (HFEs), and other fluorinated compounds as defined in 40 CFR 98.6.

You must report the annual mass of each fluorinated-GHG emitted from:

- Each fluorinated gas production process and all fluorinated gas production processes combined.
- Each fluorinated gas transformation process that is not part of a fluorinated gas production process (e.g., the transformation of an isolated intermediate into something other than a fluorinated gas) and all such fluorinated gas transformation processes combined. (However, facilities are required to separately report fluorinated GHG emissions from transformation processes where a fluorinated GHG reactant is produced at another facility).
- Each fluorinated gas destruction process that is not part of a fluorinated gas production process or a fluorinated gas transformation process (e.g., the destruction of a fluorinated GHG returned from the field) and all such fluorinated gas destruction processes combined.
- Venting of residual fluorinated GHGs from containers returned from the field.

Each facility must also report GHG emissions for other source categories for which calculation methods are provided in other subparts of the rule. For example, facilities must report carbon dioxide (CO₂), nitrous

oxide (N₂O), and methane (CH₄) emissions from each stationary combustion unit on site by following the requirements of 40 CFR part 98, subpart C (General Stationary Fuel Combustion Sources). If applicable, facilities must also report the emissions of HFC-23 from HCFC-22 production processes and HFC-23 destruction processes as required by 40 CFR part 98, subpart O (HCFC-22 Production and HFC-23 Destruction). Please refer to the relevant information sheet for a summary of the requirements for calculating and reporting emissions from any other source categories at the facility.

How Must GHG Emissions Be Calculated?

You must estimate GHG emissions using either the mass-balance approach or the emission factor or emission calculation factor approach. Regardless of the approach used to estimate fluorinated gas emissions from production and transformation processes, emissions must also be calculated for destruction processes, and for venting of residual fluorinated GHGs from containers (e.g., cylinder heels).

Scoping Speciation

To determine what processes and gases to include in your GHG report, you must sample and analyze process streams or process vents to identify all fluorinated GHGs that are generated in processes that have at least one process vent with annual uncontrolled fluorinated GHG emissions of one metric ton or more.

Mass-Balance Approach

Accuracy and precision requirements. Before using the mass-balance approach for a process, you must ensure that the process and the equipment and methods used to collect data meet either (1) certain absolute or relative error limits, or (2) specific accuracy, precision, frequency and throughput requirements.

1. A process qualifies to use the mass-balance equation under the error limits approach if either one of the two following conditions is met:
 - the absolute error of the emissions estimated under the mass-balance approach is less than or equal to 3,000 metric tons CO₂e per year, or
 - the relative error is less than or equal to 30 percent of the estimated process emissions.
2. Alternatively, a process qualifies to use the mass-balance equation if all of the following conditions are met:
 - The process must have a total annual throughput of 500,000 mtCO₂e or less, where the throughput is defined as the sum of the CO₂-weighted masses of the fluorinated GHG reactants, products, and by-products.
 - You must measure the masses and concentrations identified in the rule at least weekly, and you must calculate emissions at least weekly.
 - You must measure the masses identified in the rule with an accuracy and precision of ± 0.2 percent of full scale or better.
 - You must measure the concentrations identified in the rule using analytical methods with an accuracy and precision of ± 10 percent or better.

If neither of these conditions is met, you must use the emission factor or emission calculation factor approach for the process.

Mass-balance measurements and calculations. Under the mass-balance approach, fluorinated GHG emissions must be calculated by measuring or calculating the following variables:

- Total mass of each fluorine-containing reactant fed into the process (measured at least monthly)

- Total mass of the fluorine-containing product produced by the process (measured at least monthly)
- Total mass of fluorine in destroyed or recaptured streams containing fluorine-containing reactants, products, and byproducts
- Mass fractions of each emitted fluorinated GHG reactant, product, and by-product relative to the total mass of all emitted fluorinated GHGs

In order to calculate these variables, the following inputs must be measured at least monthly:

- Mass removed from the process in each stream that is fed into the destruction device and that contains greater than trace concentrations of fluorine-containing reactants, products, or by-products
- Mass removed from the process in each recaptured stream that contains greater than trace concentrations of fluorine-containing by-products
- Concentration (mass fraction) of each fluorine-containing reactant, product, and by-product in each stream that is fed into the destruction device
- Concentration (mass fraction) of each fluorine-containing by-product in each recaptured stream.
- Destruction efficiency of the destruction device as demonstrated for each fluorinated GHG in each stream

Process-Vent-Specific Emission Factor and Emission Calculation Factor Approach

This approach has different requirements for continuous and batch processes. For batch processes, you may develop either process-vent-specific emission factors (Emission Factor Approach) or process-vent-specific emission calculation factors (Emission Calculation Factor Approach). For continuous processes, you must perform a preliminary estimate of emissions for each process vent to determine whether you may use the Emission Calculation Factor Approach or must use the Emission Factor Approach. In either case, you must also estimate emissions from equipment leaks.

Preliminary estimate and choice of method. For continuous process vents, facilities must calculate the CO₂-equivalent emissions from each process vent using the engineering calculations or assessments specified in the rule. For fluorinated GHGs whose GWPs are not listed in Table A-1 of subpart A of part 98, you may use a default GWP of 2000. Alternatively, you may submit a request to EPA to use provisional GWPs for these fluorinated GHGs if:

- the fluorinated GHGs are emitted in quantities that, with a default GWP of 2000, result in total calculated annual emissions equal to or greater than 10,000 metric tons CO₂e for the vent, and
- you submit data and analysis that support GWPs for the fluorinated GHGs that would result in total calculated annual emissions less than 10,000 metric tons CO₂e for the vent.

If an individual continuous process vent has fluorinated GHG emissions of less than 10,000 metric tons CO₂e per year, then use either:

- Process-vent-specific emission factor method.
- Process-vent-specific emission calculation factor method.

If an individual continuous process vent within an operating scenario has fluorinated GHG emissions of greater than 10,000 metric tons CO₂e per year, then use:

- Process-vent-specific emission factor method.

If you are estimating emissions from a batch process vent, then use either:

- Process-vent-specific emission factor method.
- Process-vent-specific emission calculation factor method.

Emission factor and emission calculation factor measurements and calculations.

Under the process-vent-specific emission factor method, fluorinated GHG emissions must be calculated using the following:

- Process-vent-specific emission factor based on emission testing during representative performance of the process or operating scenario(s) of the process, as applicable.
 - If the vent is controlled and annual emissions bypassing, i.e., not venting to, the destruction device are less than 10,000 mtCO₂e, the facility may conduct emissions testing after the destruction device.
 - Otherwise, the facility must conduct emissions testing before the destruction device.
- Total annual process activity.
- Destruction efficiency, only for the portion of the process activity during which the vent is vented to a destruction device.

Under the process-vent-specific emission calculation factor method, fluorinated GHG emissions must be calculated using the following:

- Process-vent-specific emission calculation factor.
- Total annual process activity.
- Destruction efficiency, only for the portion of the process activity during which the vent is vented to a destruction device.

Equipment leaks. For both the process-vent-specific emission factor method and the process-vent-specific emission calculation factor method, information must be collected on the number and type of equipment; service of each piece of equipment; concentration of each fluorinated GHG in the stream; and the time period each piece of equipment was in service. Emissions from equipment leaks must be calculated using any of the following methods:

- Average Emission Factor Approach in the EPA Protocol for Equipment Leak Estimates.
- Other Approaches in the EPA Protocol for Equipment Leak Estimates in conjunction with EPA Method 21.
- Other Approaches in the EPA Protocol for Equipment Leak Estimates in conjunction with site-specific leak monitoring methods.
- Site-specific leak monitoring methods.

Establishing Destruction Efficiencies

If you choose to apply the destruction efficiency (DE) of a destruction device to a fluorinated GHG, you must establish the DE of that device for that fluorinated GHG. To establish the destruction efficiency, either conduct a performance test or use the destruction efficiency determined during a previous performance test that meets the rule requirements. For certain difficult-to-destroy fluorinated GHGs including CF₄, SF₆, and saturated PFCs other than CF₄, a destruction efficiency must be developed specifically for that compound or for a more difficult-to-destroy surrogate that is specified in the rule (e.g., CF₄ may be used as a surrogate for SF₆ and either CF₄ or SF₆ may be used as a surrogate for saturated PFCs). For other fluorinated GHGs, the destruction efficiency may be developed using a more-difficult-to-destroy surrogate from the list of Class 1 compounds on the Thermal Stability Rankings (Appendix D, Table D-1 of “Guidance on Setting Permit Conditions and Reporting Trial Burn Results; Volume II of the Hazardous Waste Incineration Guidance Series,” January 1989, EPA Publication EPA 625/6-89/019.)

Destruction of Fluorinated GHGs that were Previously “Produced”

Calculate emissions from the destruction of fluorinated GHGs that were previously “produced” (e.g., that are returned from the field for destruction because they are irretrievably contaminated) using the following:

- Mass of fluorinated GHGs previously “produced” that are fed into the destruction device.
- Destruction efficiency of the destruction device for each fluorinated GHG.

Venting of Residual Fluorinated GHGs in Containers

Calculate emissions from the venting of residual fluorinated GHGs from containers using one the following methods:

- Measure the contents of each container before and after venting.
- Develop a heel factor (based on representative samples) for each combination of fluorinated GHG, container size, and container type, and apply this factor to the number of containers vented.

What Information Must Be Reported?

In addition to the information required by the General Provisions at 40 CFR 98.3(c), you must report the following information:

- Annual mass in metric tons of each fluorinated GHG emitted from:
 - Each fluorinated gas production process and all fluorinated gas production processes combined.
 - Each fluorinated gas transformation process that is not part of a fluorinated gas production process and all such fluorinated gas transformation processes combined, except report separately fluorinated GHG emissions from transformation processes where a fluorinated GHG reactant is produced at another facility.
 - Each fluorinated gas destruction process that is not part of a fluorinated gas production process or a fluorinated gas transformation process and all such fluorinated gas destruction processes combined.
 - Venting of residual fluorinated GHGs from containers returned from the field.
- Chemical identities of the contents of the process or emissions stream(s) analyzed under the initial scoping speciation of fluorinated GHG, by process.
- Location and function of the process or emissions stream(s) that were analyzed under the initial scoping speciation of fluorinated GHG, by process.
- Method used to determine the mass of emissions of each F-GHG, for each process and process vent at the facility.
- Chemical formula and total mass produced of the fluorinated gas product in metric tons, by chemical and process.
- Missing data periods, including reporting the reasons for the missing data, the length of time the data were missing, the method used to estimate values for missing data, and the estimates of those data.

In addition, facilities must report information specific to each method that they use to estimate emissions from their processes. Please see the final rule for the reporting requirements for facilities using each estimation method.

Fluorinated gas production facilities that destroy fluorinated GHGs must submit:

- Excess emissions that result from malfunctions of the destruction device.
- Destruction device testing report.

- For each previously produced fluorinated GHG destroyed:
 - The mass of the fluorinated GHG fed into the destruction device.
 - The mass of the fluorinated GHG emitted from the destruction device.
- A one-time report by June 30, 2011, that describes any measurements, research, or analysis that it has performed or obtained that relate to the formation of products of incomplete combustion (PICs) that are fluorinated GHGs during the destruction of fluorinated gases.

Fluorinated gas production facilities that vent residual fluorinated GHGs from containers must report the following for each fluorinated GHG vented:

- Annual mass of the residual fluorinated GHG vented from each container size and type (metric tons).
- If applicable, the heel factor calculated for each container size and type.

For More Information

Visit EPA's Web site (www.epa.gov/climatechange/emissions/ghgrulemaking.html) for more information and additional information sheets, or go to www.regulations.gov to access the rulemaking docket EPA-HQ-OAR-2009-0927.

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